DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Digital Intensity Catalog of Earthquakes Felt in Alaska and the Aleutian Islands, 1786–1981

by

S. R. Brockman, A. F. Espinosa and J. A. Michael

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

DIGITAL INTENSITY CATALOG OF EARTHQUAKES FELT IN ALASKA AND THE ALEUTIAN ISLANDS, 1786–1981

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A database of historic and instrumental earthquakes that have been felt in Alaska since 1786 has been compiled from several sources in support of the Seismic Hazard Studies, Anchorage, Alaska project. All of Alaska is represented, including the western Aleutian Islands (figure 1). More than 5200 intensity entries, comprising over 3100 earthquakes, are contained in the database. Shown in figures 2a and 2b are the maximum Modified Mercalli intensity ratings (I_0's) for earthquakes with $I_0 \geq$ VI. These figures provide the user with an overview of the locations of the most significant earthquakes in Alaska and the Aleutians for which there are intensity data available.

Figure 1.–Selected geographic features and localities in Alaska and vicinity. Modified-Stereographic Conformal Projection.

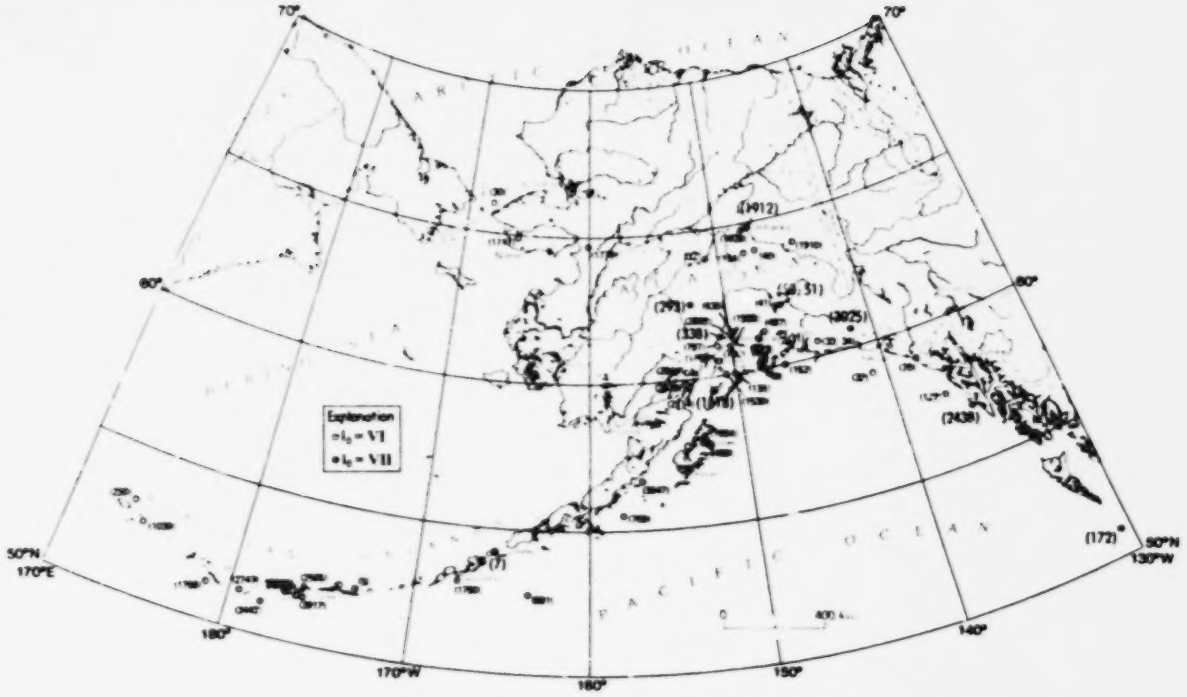

Figure 2a.–Maximum intensity (I_o) for earthquakes which have occurred from 1899 through 1981 in Alaska with I_o = VI (○), and I_o = VII (●). The earthquake number for each epicenter is shown in parentheses. Modified-Stereographic Conformal Projection. (From Brockman and others, 1987.)

Figure 2b.–Maximum intensity (I_o) for earthquakes which have occurred from 1899 through 1981 in Alaska with $I_o \geq$ VIII. Epicenters are shown as dots. Their I_o ratings are denoted by Roman numerals adjacent to the dots. The earthquake number for each epicenter is shown in parentheses. Modified-Stereographic Conformal Projection. (From Brockman and others, 1987.)

The intensity data have been fully documented and formatted into three tables (see samples in figure 3) in a U. S. Geological Survey Bulletin publication (Brockman and others, 1987). Information included in the database are: date, time, latitude, longitude, magnitude, depth, distance to the locality that felt the earthquake, the name of the locality and the Modified Mercalli intensity value that was reported there.

The data are being made available in the form of three files on magnetic tape in order to ensure timely access to other users. Shown in figures 4, 5 and 6 are sample portions of the three files displaying some of the data and how it is formatted. A generalized list of references and sources of information that were used in compiling the data is also included at the end of this paper.

File 1 is the primary intensity database and is the first file on the tape. In it, all known earthquake parameters (date, time, epicentral location, magnitude, and depth) and intensity information (name and location of the reporting locality, the distance of the locality from the earthquake, and the reported intensity) are listed. Numbers have been sequentially assigned to each earthquake and are intended to be used as earthquake cross reference numbers between this file and the other two described below. A detailed description of the record format for each file is given below and a sample portion of the file is shown in figure 4.

File 2 is a subset of the data listed in File 1. The earthquake epicenters have been ordered into groups by the maximum intensity rating (I_0) for the event and are listed in descending order by I_0 group beginning with I_0 = XI. Events are listed chronologically within each group. Each record contains the sequential earthquake number, date, epicentral location, magnitude (if any), and I_0. Figure 5 shows a sample of File 2.

File 3 contains a listing (a portion of which is shown in figure 6) of those events that have magnitudes assigned to them. Because there are often several different magnitudes computed for a given event, there are multiple entries for many of the earthquakes identified with the same earthquake number. The events are listed chronologically, with each record containing the earthquake number, date, epicentral location, I_0, a magnitude, the magnitude type and a code representing the source of the magnitude data. An explanation of the codes and their associated references is given below in the record format description for File 3.

	EARTHQUAKE PARAMETERS						INTENSITY INFORMATION				
Eq.	Date	Time	Epicenter	Mag	Dep	Δ	Obs. Location		INT	Locality
No.	Yr Mo Dy	Hr Mn Sec	Lat °N Lon °W		km	km	Lat °N	Lon °W	MM	
1514	1961 03 28	12 29 12.7	51.70 176.20	6.3	60	36	51.86	176.66	3	Adak
1515	1961 03 28	13 58 58.8	52.00 176.00		89	48	51.86	176.66	3	Adak
1516	1961 04 04	12 52					60.58	151.31	3	Kenai
1517	1961 04 27	02 15					51.86	176.66	3	Adak
1518	1961 04 29	05 34 13					65.00	150.63	3	Manley Hot Springs
1519	1961 05 17	19 29 19.3	52.20 173.90E	6.0	21	60	52.72	174.11E	3	Shemya
1520	1961 05 26	13 57					51.86	176.66	3	Adak

Figure 3a.–A sample portion of table 1, from Brockman and others (1987), listing the earthquake parameters and intensity data. Compare with figure 4 which is a sample of the digital data as it is formatted in File 1 on the magnetic tape.

Eq.No.	Year Mo Dy	Lat °N Lon °W	Mag
5	1812	52.00 174.50	
20	1903 07 26	59.00 138.00	
22	1904 08 27	64.00 151.00	8.3
30	1907 12 29	66.00 168.00	
31	1908 02 14	61.00 146.25	
32	1908 05 15	59.00 141.00	
33	1908 10 29	60.50 144.00	
34	1908 11 02	60.50 144.00	

Figure 3b.–A sample portion of table 2, from Brockman and others (1987), listing the data by I_0. Compare with figure 5 which is a sample of the digital data as it is formatted in File 2 on the magnetic tape.

Eq.No.	Year Mo Dy	Lat °N Lon °W	I_0	Magnitude
14	1899 09 04	60.00 142.00	10	8.3
				7.9 M_S AN2
				7.7 m BG
				8.3 M_S CFR
				8.2 M_S EPB
				8.35 M_S GR
				8.2 M_S SJD
15	1899 09 10	60.00 140.00	11	8.6
				8.0 M_S AN2
				7.9 m BG
				8.6 M_S CFR
				8.6 M_S EPB

Figure 3c.–A sample portion of table 3, from Brockman and others (1987), listing all available magnitudes for the earthquakes studied. Compare with figure 6 which is a sample of the digital data as it is formatted in File 3 on the magnetic tape.

The three files may be obtained by sending a 9-track tape and a note specifying

1) Preferred format, whether ASCII or EBCDIC.

2) Preferred density, either 1600 or 6250 bits per inch.

Send tapes and requests to the following address:

EIS request: B.G. Reagor
U.S. Geological Survey
Box 25046, MS 967
Denver Federal Center
Denver, Colorado 80225

Phone: (303)236–1500; FTS 776–1500

The files are separated from each other on the tape with single End of File (EOF) marks and the End of Information indicated after the last file by a second EOF mark.

DESCRIPTIONS OF THE RECORD FORMATS

File 1 Description

```
1514 1961 03 28 12 29 12.7 51.70 176.20  6.3  60   36 51.86 176.66   3 Adak
1515 1961 03 28 13 58 58.8 52.00 176.00       89   48 51.86 176.66   3 Adak
1516 1961 04 04 12 52                               60.58 151.31   3 Kenai
1517 1961 04 27 02 15                               51.86 176.66   3 Adak
1518 1961 04 29 05 34 13.8                          65.00 150.63   3 Manley Hot Springs
1519 1961 05 17 19 29 19.3 52.20 173.90E 6.0  21   68 52.72 174.11E  3 Shemya
1520 1961 05 26 13 57                               51.86 176.66   3 Adak
```

Figure 4.–Sample listing of the digital data described in this publication contained in File 1 on the magnetic tape. The data format is described in detail below.

Columns	*Format*	
		Earthquake Number
2–5	(I4)	A sequential number assigned to each earthquake; used as identifier and cross-reference from file to file.
		Date
7–10	(I4)	Year of the earthquake
12–13	(I2)	Month
15–16	(I2)	Day
		Origin Time (UTC)
18–19	(I2)	Hour
21–22	(I2)	Minute
24–27	(F4.1)	Seconds

Columns	*Format*	
		Epicenter Location
29–33	(F5.2)	Geocentric latitude in degrees North.
35–40	(F6.2)	Longitude, in degrees East or West as indicated in the following column:
41	(A1)	'E', if East Longitude; a blank implies West longitude.
		Magnitude
43–45	(F3.1)	Usually a USGS (or predecessor agency) magnitude. More information about magnitude type(s) and identification source is available in File 3 Description.
		Depth
47–49	(I3)	Hypocentral depth in kilometers.
		Distance
51–54	(I4)	Epicentral distance, Δ, to reporting location in kilometers.
		Coordinates of the reporting location
56–60	(F5.2)	Geocentric latitude in degrees North.
62–67	(F6.2)	Longitude, in degrees East or West as indicated in the following column:
68	(A1)	'E', if East longitude; a blank implies West longitude.
		Intensity
70–71	(I2)	Modified Mercalli intensity rating assigned to the reporting location.
		Locality
73–98	(A26)	The name or a description of the locality from which the report of damage or ground motion information originated.

File 2 Description

```
 5 1812          52.00 174.50          6
20 1903 07 26 59.00 138.00             6
22 1904 08 27 64.00 151.00  8.3        6
30 1907 12 29 66.00 168.00             6
31 1908 02 14 61.00 146.25             6
32 1908 05 15 59.00 141.00             6
33 1908 10 29 60.50 144.00             6
34 1908 11 02 60.50 144.00             6
```

Figure 5.–Sample listing of the digital data described in this publication contained in File 2 on the magnetic tape. The data format is described in detail below.

Columns	*Format*	
		Earthquake Number
2–5	(I4)	A sequential number assigned to each earthquake; used as identifier and cross-reference from file to file.

Columns	*Format*	
		Date
7–10	(I4)	Year of the earthquake
12–13	(I2)	Month
15–16	(I2)	Day
		Epicenter location
18–22	(F5.2)	Geocentric latitude in degrees North.
24–29	(F6.2)	Longitude, in degrees East or West as indicated in the following column:
30	(A1)	'E', if East Longitude; a blank implies West longitude.
		Magnitude
32–34	(F3.1)	Usually a USGS (or predecessor agency) magnitude. More information about magnitude type(s) and identification source is available in File 3 Description.
		I_0
32–33	(I2)	Maximum Modified Mercalli intensity rating assigned to the earthquake.

File 3 Description

```
14 1899 09 04 60.00 142.00  10 7.9  Ms AN2
14 1899 09 04 60.00 142.00  10 7.7  m  BG
14 1899 09 04 60.00 142.00  10 8.3  Ms CFR
14 1899 09 04 60.00 142.00  10 8.2  Ms EPB
14 1899 09 04 60.00 142.00  10 8.35 Ms GR
14 1899 09 04 60.00 142.00  10 8.2  Ms SJD
15 1899 09 10 60.00 140.00  11 8.0  Ms AN2
15 1899 09 10 60.00 140.00  11 7.9  m  BG
15 1899 09 10 60.00 140.00  11 8.6  Ms CFR
15 1899 09 10 60.00 140.00  11 8.6  Ms EPB
```

Figure 6.–Sample listing of the digital data described in this publication contained in File 3 on the magnetic tape. The data format is described in detail below.

Columns	*Format*	
		Earthquake Number
2–5	(I4)	A sequential number assigned to each earthquake; used as identifier and cross-reference from file to file.
		Date
7–10	(I4)	Year of the earthquake
12–13	(I2)	Month
15–16	(I2)	Day

Columns	*Format*	
		Epicenter location
18–22	(F5.2)	Geocentric latitude in degrees North.
24–29	(F6.2)	Longitude, in degrees East or West as indicated in the following column:
30	(A1)	'E', if East Longitude; a blank implies West longitude.
		I_0
32–33	(I2)	Maximum Modified Mercalli intensity rating assigned to the earthquake.
		Magnitude
35–38	(F4.2)	Numerical value of the magnitude.
40–41	(A2)	Magnitude type, where Ms=Surface-wave magnitude mb=Body-wave magnitude ML=Richter magnitude Mc=Coda-length magnitude m =Unified magnitude
43–45	(A3)	Magnitude reference code, where AN1=*Abe and Noguchi, 1983a* AN2=*Abe and Noguchi, 1983b* BD =*Båth and Duda, 1979* BG =*Gutenberg, 1956* BRK=University of California, Berkeley, California CFR=*Richter, 1958* CGS=U.S. Coast and Geodetic Survey, until October, 1970 COL=U.S. Geological Survey, College, Alaska CUC=CIRES, Univ. of Colorado, Boulder, Colorado EPB=Earth Physics Branch, Seismological Services of Canada, Ottawa, Ontario, Canada ERL=Environmental Research Laboratories (NOAA), July 1971–August 1973 GIA=Univ. of Alaska, Geophysical Institute, Fairbanks, Alaska GOL=Bergen Park, Colo. School of Mines, Golden, Colorado GR =*Gutenberg and Richter, 1954*

GS =U.S. Geological Survey,
August 1973 through the present

GSM=U.S. Geological Survey,
Menlo Park, California

ISC=International Seismological Center,
Newbury, United Kingdom

KA1=*Abe, 1981*

KA2=*Abe, 1984*

NOS=National Ocean Survey (NOAA),
October 1970–June 1971

PAL=Lamont-Doherty Geol. Obs., Columbia Univ.,
Palisades, New York

PAS=California Inst. of Technology,
Pasadena, California

PMR=Tsunami Warning Center,
Palmer, Alaska

PRU=Pruhonice, Czechoslovakia

SJD=*Duda, 1965*

SSR=*Kondorskaya and Shebalin, 1982*

UPP=Seismological Obs., Univ. of Uppsala,
Uppsala, Sweden

DATA SOURCES AND REFERENCES

Abe, K., 1981, Magnitudes of large shallow earthquakes from 1904 to 1980: Physics of the Earth and Planetary Interiors, v. 27, p. 72–92.

Abe, K., 1984. Complements to "Magnitudes of large shallow earthquakes from 1904 to 1980": Physics of the Earth and Planetary Interiors, v. 34, p. 17–23.

Abe, K. and Noguchi, S., 1983a, Determination of magnitude for large shallow earthquakes, 1898–1917: Physics of the Earth and Planetary Interiors, v. 32, p. 45–59.

Abe, K. and Noguchi, S., 1983b, Revision of magnitudes of large shallow earthquakes, 1897–1912: Physics of the Earth and Planetary Interiors, v. 33, p. 1–11.

Båth, M. and Duda, S. J., 1979, Some aspects of global seismicity: Seismological Institute Report No. 1-79, Uppsala, Sweden, 39 p. and 2 figures.

Brockman, S. R., Espinosa, A. F. and Michael, J. A., 1987, Catalog of intensities, I_0's, and their corresponding magnitudes for earthquakes in Alaska and the Aleutian Islands, 1786–1981: U.S. Geological Survey Bulletin, 205 p.

Cloud, W. K. and Scott, N. H., 1972, Distribution of intensity: *in* National Academy of Sciences, The Great Alaska Earthquake of 1964, Seismology and Geodesy, p. 65–108.

Coffman, J. L., VonHake, C. A. and Stover, C. W., eds., 1982, Earthquake history of the United States, with a supplement through 1980: U.S. Department of Commerce and U.S. Geological Survey, Publication 41-1, 158 p.

Davies, J., Sykes, L., House, L. and Jacob, K., 1982, Shumagin seismic gap, Alaska Peninsula: history of great earthquakes, tectonic setting, and evidence for high seismic potential: Geophysical Research Journal, v. 86, no. B5, p. 3821–3855.

Davis, T. N. and Sanders, N. K., 1960, Alaska earthquake of July 10, 1958: Intensity distribution and field investigation of northern epicentral region, Seismological Society of America Bulletin, v. 50, p. 221–252.

Duda, S. J., 1965, Secular seismic energy release in the circum-Pacific belt: Tectonophysics, v. 2, no. 5, p. 409–452.

Espinosa, A. F., 1984, Seismicity of Alaska and the Aleutian Islands, 1960–1983: U.S. Geological Survey Open-File Map 84-855, 1 sheet.

Espinosa, A. F., Brockman, S. R. and Michael, J. A., 1986, Modified-Mercalli intensity distribution for the most significant earthquakes in Alaska, 1899–1981: U.S. Geological Survey Open-File Map 86-203, 1 sheet.

Fogleman, K. A., Stephens, C. D., Lahr, J. C., Cancilla, R. S., Roy Tam, Freiberg, J. A. and Melnick, J. P., 1983, Catalog of earthquakes in southern Alaska, April–June 1980: U.S. Geological Survey Open-File Report 83-14, 54 p.

Fogleman, K. A., Stephens, C. D., Lahr, J. C., Cancilla, R. S., Roy Tam, Freiberg, J. A. and Melnick, J. P., 1983, Catalog of earthquakes in southern Alaska, July–September 1980: U.S. Geological Survey Open-File Report 83-15, 54 p.

Gutenberg, B., 1956, Great earthquakes 1896–1903: Transactions, American Geophysical Union, v. 37, no. 5, p. 608–614.

Gutenberg, B. and Richter, C. F., 1954, Seismicity of the earth and associated phenomena: Princeton University Press (second edition); facsimile of 1954 edition published in 1965 by Hafner Publishing Company, New York, 310 p.

Gutenberg, B. and Richter, C. F., 1956, Earthquake magnitude, intensity, energy, and acceleration (second paper): Bulletin of the Seismological Society of America, v. 46, no. 2, p. 105–146.

Harding, S. T. and Algermissen, S. T., 1972, The focal mechanism of this and related earthquakes: *in* National Academy of Sciences, The Great Alaska Earthquake of 1964, Seismology and Geodesy, p. 197–233.

Jordan, J. N., Lander, J. F. and Black, R., 1965, Aftershocks of the 4 February 1965 Rat Islands earthquake: Science, v. 148, p. 1323.

Jordan, J. N., Dunphy, G. J., and Harding, S. T., 1968, Preliminary seismological report, *in* The Fairbanks, Alaska, earthquakes of June 21, 1967: U.S. Department of Commerce, Environmental Science Services Administration, p. 1–32.

Kondorskaya, N. V. and Shebalin, N. V., eds., 1982, New catalog of strong earthquakes in the USSR from ancient times through 1977: World Data Center A for Solid Earth Geophysics, Report SE31, Boulder, Colorado, 608 p.

Meyers, H., Brazee, R. J., Coffman, J. L. and Lessig, S. R., 1976, An analysis of earthquake intensities and recurrence rates in and near Alaska: U.S. Dept. of Commerce, National Oceanic and Atmospheric Admin. Technical Memorandum EDS NGSDC-3, 101 p.

Orth, D. J., 1967, Dictionary of Alaska place names: U.S. Geological Survey Professional Paper 567, 1084 p.

Richter, C. F., 1958, Elementary seismology: W.H. Freeman and Company, San Francisco, California, 768 p.

Seismological Service of Canada, Earth Physics Branch, 1960–1979, Canadian earthquakes: A series of annual publications by various authors.

Stephens, C. D., Fogleman, K. A., Lahr, J. C., Helton, S. M., Cancilla, R. S., Roy Tam and Freiberg, J. A., 1980, Catalog of earthquakes in southern Alaska, January–March 1980: U.S. Geological Survey Open-File Report 80-1253, 55 p.

Stephens, C. D., Lahr, J. C., Fogleman, K. A., Helton, S. M., Cancilla, R. S., Roy Tam and Baldonado, K. A., 1980, Catalog of earthquakes in southern Alaska, October–December 1979: U.S. Geological Survey Open-File Report 80-2002, 53 p.

Stephens, C. D., Lahr, J. C., Fogleman, K. A. and Horner, R. B., 1980, The St. Elias, Alaska, earthquake of February 28, 1979: Regional recording of aftershocks and short-term, pre-earthquake seismicity: Bulletin of the Seismological Society of America, v. 70, no. 5, p.1607–1633.

Stephens, C. D., Astrue, M. S., Pelton, J. R., Fogleman, K. A., Page, R. A., Lahr, J. C., Allan, M. A. and Helton, S. M., 1982, Catalog of earthquakes in southern Alaska, April–June 1978: U.S. Geological Survey Open-File Report 82-488, 36 p.

Stover, C. W., Reagor, B. G. and Wetmiller, R. J., 1980, Intensities and isoseismal map for the St. Elias earthquake of February 28, 1979: Seismological Society of America, v. 70, no. 5, p. 1635–1649.

Tarr, R. S. and Martin, L., 1912, The earthquakes at Yakutat Bay, Alaska, in September, 1899: U.S. Geological Survey Professional Paper 69, 135 p.

U.S. Dept of Commerce, Environmental Science Services Administration, 1968, The Fairbanks, Alaska earthquakes of June 21, 1967, 60 p.

United States Earthquakes. Annual publication of the U.S. Department of Commerce, Coast and Geodetic Survey from 1928 through 1968, the NOAA National Ocean Survey for 1969, the NOAA Environmental Data Service through 1972, the NOAA/EDS jointly with the U.S. Geological Survey through 1980, and the USGS from 1981 to the present.

Wood, H. O. and Neumann F. N., 1931, Modified Mercalli intensity scale of 1931: Seismological Society of America Bulletin, v. 21, p. 277–283.